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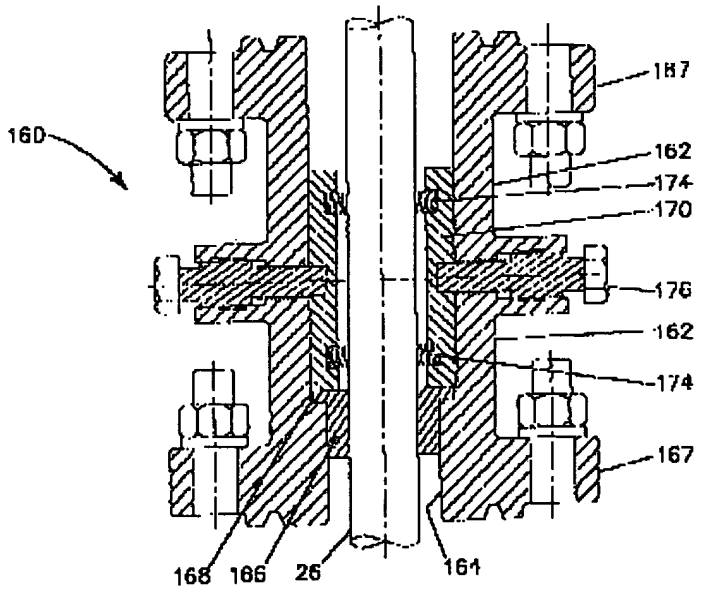
(54) Titre : ATTACHE VERROUILLABLE D'UNE TIGE POLIE
(54) Title: POLISH ROD LOCKING CLAMP



(57) Abrégé/Abstract
A polished rod lock out clamp for use in securing the polished rod in an oil well installation, comprising a clamp body having a bore for receiving a polished rod in spaced relation to the bore, clamp members in the clamp body for engaging a polished rod in the bore; and radial bolts secured to the clamp body and the clamp members for moving the clamp members between a polished rod gripping position where the clamp members grippingly engage the polished rod to prevent rotation and axial movement thereof and a retracted position where the clamp members are removed from the polished rod to permit rotational and axial movement of the polished rod in the bore of the clamp body.

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WE CLAIM:

1. A polished rod lock out clamp operable to suspend a polished rod in an oil well installation, comprising:

a clamp body having a bore for receiving the polished rod therethrough in spaced relation to said bore;

clamp members in said clamp body for gripping the polished rod in said bore; and

manipulating means secured to said clamp body and said clamp members for moving said clamp members between a polished rod gripping position in which said clamp members grippingly engage said polished rod in metal to metal contact therebetween to prevent rotation or axial movement of the polished rod, and a retracted position in which said clamp members are removed from the polished rod to permit rotational and axial movement of the polished rod in said bore of said clamp body.

2. A clamp as defined in **claim 1**, each said clamp member being radially movable with respect to said polished rod and having an arcuate inner surface for engaging said polished rod thereinto.

3. A clamp as defined in **claim 2**, wherein the diameter of said inner surface is slightly less than the diameter of the polished rod to enhance gripping force.

4. A clamp as defined in **claims 1, 2 or 3**, wherein each said clamp member is in the form of a piston, said clamp body having a piston bore for each said piston, each said piston bore extending radially of said bore of said clamp body, each said piston having an inner end proximate said bore of said clamp body, said arcuate inner surface being formed in said inner end to be semi-circular in shape for receiving and grippingly engaging said polished rod.

5. A clamp as defined in **claim 4**, comprising a pair of said pistons radially opposed to one another.

6. A clamp as defined in **claim 5**, said pistons having mutually engageable end faces at said inner ends thereof and seal means disposed between said end faces, said pistons being sealingly disposed in said piston bores and being sealingly engageable with said polished rod and with each other to prevent well fluids from escaping past said clamp when said pistons are disposed in said gripping positions thereof.

7. A clamp as defined in **claims 2 or 3**, said clamp members comprising a pair of opposed clamp members each forming an elongated segment of a cylinder and each having a said arcuate inner surface for engagement with the polished rod.

8. A clamp as defined an **any of claims 1 to 7** including resilient members disposed between said clamp members to normally bias said clamp members towards said retracted position thereof.

9. A clamp as defined in **any of claims 1 to 8**, said manipulating means including, for each clamp member, a bolt threaded into said clamp body for moving said clamp member between said gripping and retracted positions thereof.

10. The clamp as defined in **claim 9**, wherein each said bolt includes a shaped portion formed on an inner end thereof for mating engagement with a correspondingly shaped slot in a respective clamp member for moving said members into said retracted position thereof.

11. A clamp as defined in **any of claims 1 to 10**, wherein said clamp is arranged to be secured between a polished rod drive head and a well head of the oil well installation.

12. A clamp as defined in **any of claims 1 to 11**, wherein said clamp forms part of a drive head for driving the polished rod.

13. A clamp as defined in **any of claims 1 to 12**, further including means for centering said polished rod in said bore of said clamp body.

14. A clamp as defined in **any of claims 1 to 13**, further including means for axially locating said clamp members in said clamp body and for transferring axial and rotational loads from said clamp members to said clamp body.

15. A polished rod lock out clamp for use to temporarily suspend a polished rod in an oil well installation, comprising:

a clamp body having a bore therethrough for receiving the polished rod in spaced relation to said bore;

metal clamp members in said clamp body for engaging the polished rod in said bore, each said clamp member being radially movable with respect to the polished rod and each

having a recess formed therein for grippingly receiving and engaging said polished rod for metal to metal contact therewith; and

manipulating means secured to said clamp body and said clamp members for moving said clamp members between a polished rod gripping position in which said clamp members grippingly engage the polished rod to prevent rotation or axial movement thereof and a retracted position in which said clamp members are removed from the polished rod to permit rotational and axial movement of the polished rod in said bore of said clamp body.

16. A clamp as defined in **claim 15**, wherein the diameter of said recess is slightly less than the diameter of the outer surface of said polished rod to enhance gripping force.

17. A clamp as defined in **claims 15 or 16**, said clamp body further having piston bores extending radially of said bore of said clamp body, each said clamp member comprising a piston disposed in a piston bore, each piston having an inner end in which said recess is formed for receiving and grippingly engaging the polished rod.

18. A clamp as defined in **claim 17**, comprising a pair of said pistons radially opposed to one another.

19. A clamp as defined in **claims 15 or 16**, wherein said clamp members comprise two or more opposed clamp members each forming an elongated segment of a cylinder and each having said recess formed therein for engagement with the polished rod and an arcuate outer surface for engagement with said bore of said clamp body.

20. A clamp as defined in **claims 15, 16, 17, 18 or 19**, said manipulating means including a bolt secured to each said clamp member, said bolts being threadedly engaged with respective radially extending threaded holes in said clamp body for radial movement of said bolts and said clamp members, said bolts extending outwardly of said clamp body for manipulation thereof.

21. A clamp as defined in **any of claims 15 to 20**, each said clamp member having a dovetail slot and a dovetail key formed on inner ends of said bolts for mating engagement with said dovetail slots for securing said bolts and associated clamp members.

22. A clamp as defined in **any of claims 15 to 21** including resilient members disposed between said clamp members to normally bias said clamp members towards said retracted position thereof.

23. A combined blow out preventer and polished rod lock out clamp for use in an oil well installation, comprising:

a housing having a bore for receiving a polished rod in spaced relation therethrough and opposed bores extending radially of said bore of said housing;

clamp members in said housing for grippingly engaging said polished rod in said bore, each said clamp member comprising a metallic piston disposed in one of said radial bores, each piston having an inner end and a concavely curved recess in said inner end for receiving and grippingly engaging said polished rod in metal to metal contact along at least a portion of the length of said recess to suspend said polished rod in said oil well installation;

elastomeric seal means to provide a seal between a portion of the length of said recess in said piston and said polished rod, a seal between said pistons and sealing of each piston in its associated radial bore to prevent well fluid from coming up a well bore and escaping to the exterior of the well bore when said pistons grippingly engage the polished rod; and

manipulating means secured to said housing and said pistons for moving said pistons between a polished rod gripping position in which said pistons grippingly engage said polished rod to prevent rotation or axial movement thereof and a retracted position in which said pistons are removed from said polished rod to permit rotational and axial movement of said polished rod in said bore of said clamp housing.

24. A clamp as defined in **claim 23**, wherein said manipulating means include a bolt secured to each said piston, said bolts being threadedly engaged with radially extending threaded holes in said clamp body for radial movement of said bolts and said pistons, said bolts extending outwardly of said clamp body for manipulation thereof.

25. A clamp as defined in **claims 23 or 24** including resilient members disposed between said clamp members to normally bias said clamp members towards said retracted position thereof.

26. A clamp as defined in **claim 23, 24 or 25**, wherein the diameter of said curved recess is slightly less than the diameter of the outer surface of the polished rod.

27. The clamp as defined in **claim 24, 25 or 26**, wherein each said bolt includes a shaped portion formed on an inner end thereof for mating engagement with a correspondingly shaped slot in a respective clamp member for moving said members into said retracted position thereof.

28. A polished rod lock out clamp operable to suspend a polished rod in an oil well installation, comprising:

a clamp body having an axial bore for receiving the polished rod in spaced relation to said bore;

clamp members in said clamp body having an elongated arcuate inner metallic surface for grippingly engaging the polished rod in metal to metal contact, each said clamp member being radially moveable with respect to the polished rod; and

radially disposed bolts threaded into said clamp body for manipulation of said clamp members for moving said clamp members between a polished rod gripping position in which said clamp members grippingly engage said polished rod to prevent rotation or axial movement of the polished rod and a retracted position in which said clamp members are removed from the polished rod to permit rotational and axial movement of the polished rod relative to said axial bore of said clamp body.

29. A clamp as defined in **claim 28**, wherein said radially disposed bolts have T-shaped inner portions to hook into correspondingly shaped slots in said clamp members to move said clamp members to said retracted position thereof.

30. A clamp as defined in **claims 28 or 29**, wherein said clamp members comprise a pair of opposed clamp members each forming an elongated segment of a cylinder and each having on an inner surface thereof said arcuate inner surface for engagement with the polished rod, and a curved outer surface for contact with said bore of said clamp body.

31. A clamp as defined in **claim 28 or 29**, wherein each said clamp member is in the form of a piston, said clamp body having a piston bore for each said piston, each said piston bore extending radially of said axial bore of said clamp body, each said piston having an inner end proximate said axial bore of said clamp body, said arcuate inner surface being formed in said inner end to be semi-circular in shape for receiving and grippingly engaging said polished rod.

32. A clamp as defined in **claim 31**, comprising a pair of said pistons radially opposed to one another.

33. A clamp as defined in **any of claims 27 to 31**, wherein the diameter of said arcuate inner surface is slightly less than the diameter of the outer surface of the polished rod for enhanced gripping force.

34. A clamp as defined in **claims 31, 32 or 33**, said pistons having mutually engageable end faces at said inner ends thereof and seal means disposed between said end faces, said pistons being sealingly disposed in said piston bores and being sealingly engageable with said polished rod and with each other to prevent well fluids from escaping past said clamp when said pistons are disposed in said gripping positions thereof.

35. A polished rod lock out clamp, with blow out preventer seals, operable to suspend a polished rod in an oil well installation, comprising:

a clamp body having an axial bore for receiving the polished rod in spaced relation to said bore;

two radially opposed pistons acting as clamp members, said clamp body having a piston bore for each said piston, each said piston bore extending radially of said axial bore of said clamp body, each said piston having an inner end proximate said axial bore of said clamp body, an arcuate inner surface being formed in said inner end to be semi-circular in cross-sectional shape for receiving and grippingly engaging said polished rod in metal to metal contact;

radially disposed bolts threaded into said clamp body for manipulation of said pistons for moving said pistons between a polished rod gripping position in which said pistons grippingly engage the polished rod to prevent rotation or axial movement of the polished rod and a retracted position in which said pistons are removed from the polished rod to permit rotational and axial movement of the polished rod in said axial bore of said clamp body; and

said pistons each having an elastomeric seal to seal between the polished rod and a portion of the length of said arcuate inner surface in each said piston, between said opposed pistons and between each said piston and its associated radial bore to prevent well fluids from escaping from the well bore, said elastomeric seals being compressible to allow said pistons to make metal to metal contact with said polished rod when said pistons are in said gripping position thereof.

36. A clamp as defined in **claim 35**, wherein the radius of curvature of said arcuate inner surface is slightly less than the radius of curvature of the outer surface of the polished rod.

37. A clamp as defined in **claims 35 or 36**, wherein said radially disposed bolts have T-shaped inner portions to hook into correspondingly shaped slots in said clamp members to retract said clamp members to said retracted positions thereof.

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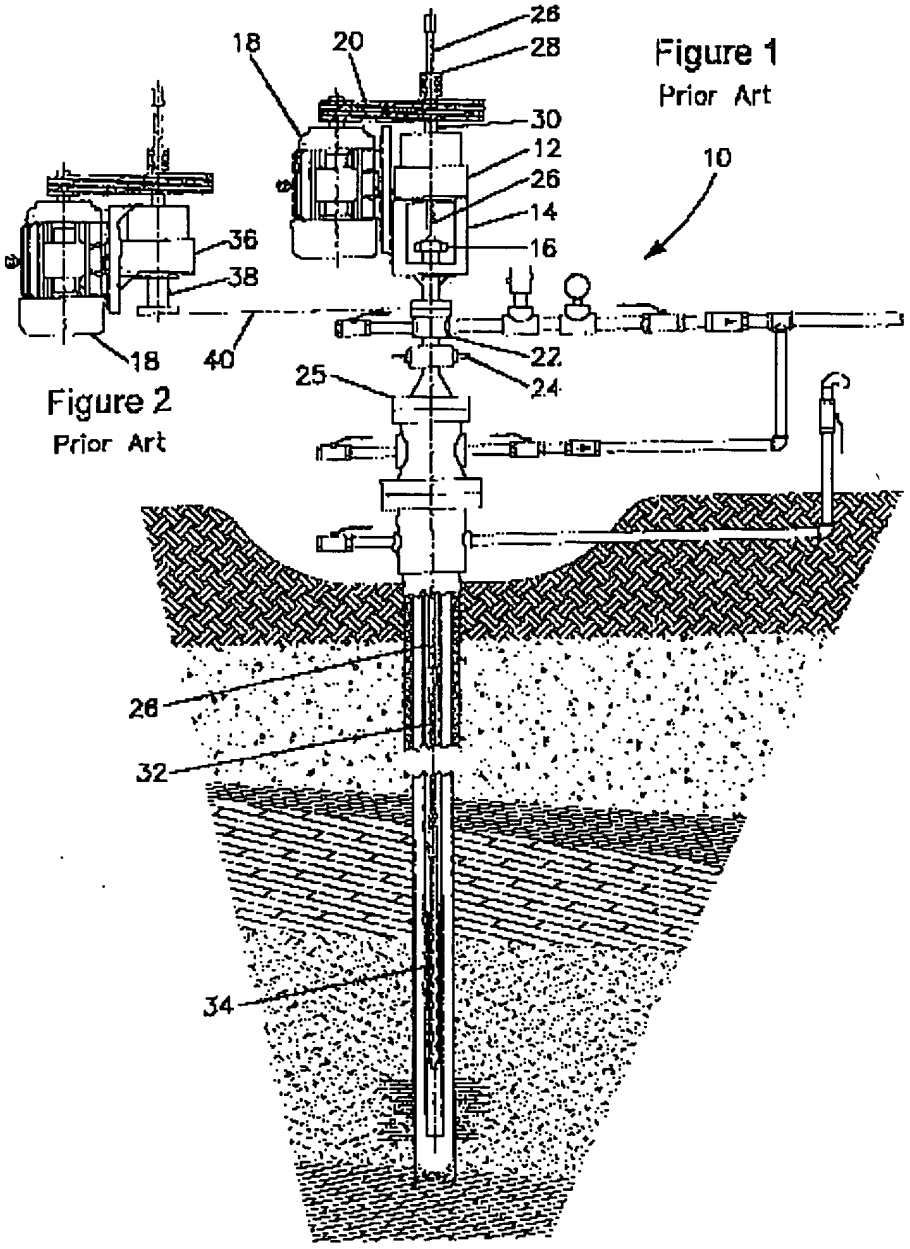

Figure 1
Prior Art

Figure 2
Prior Art

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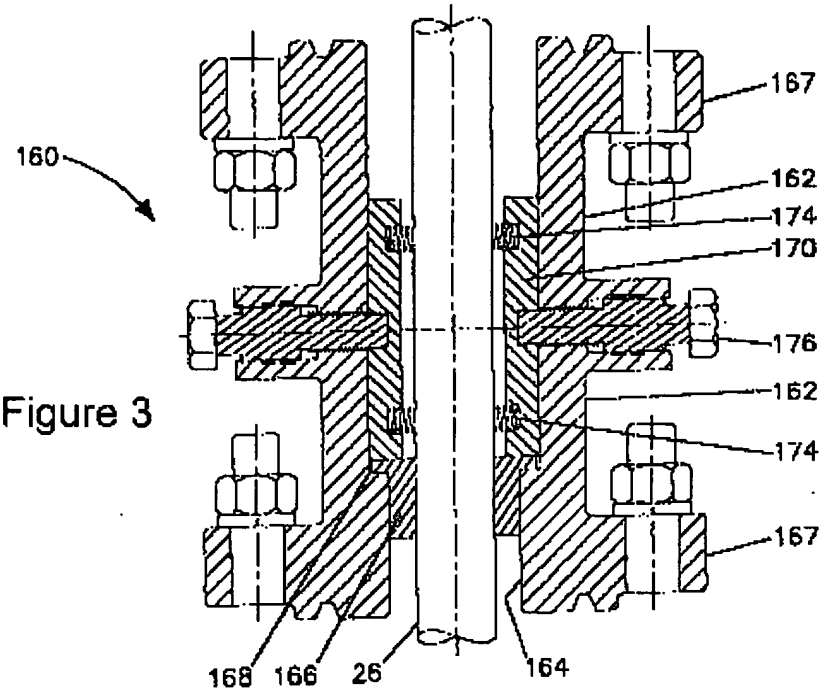

Figure 3

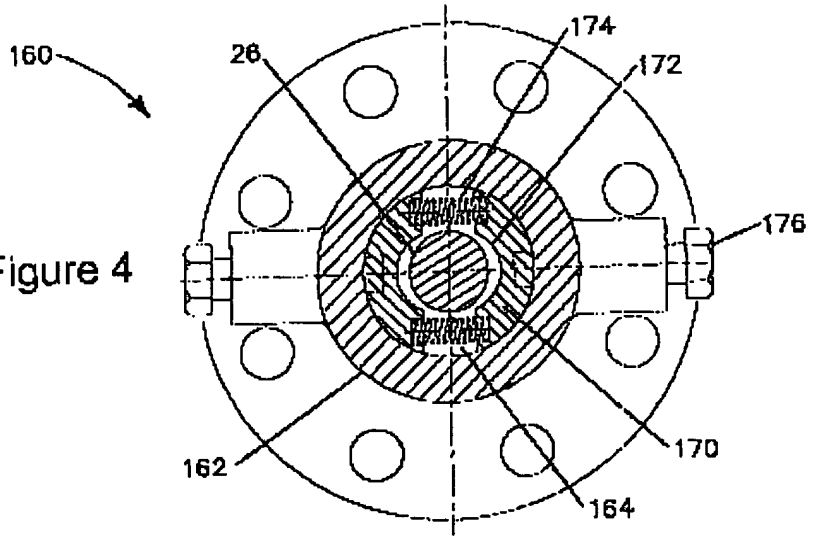

Figure 4

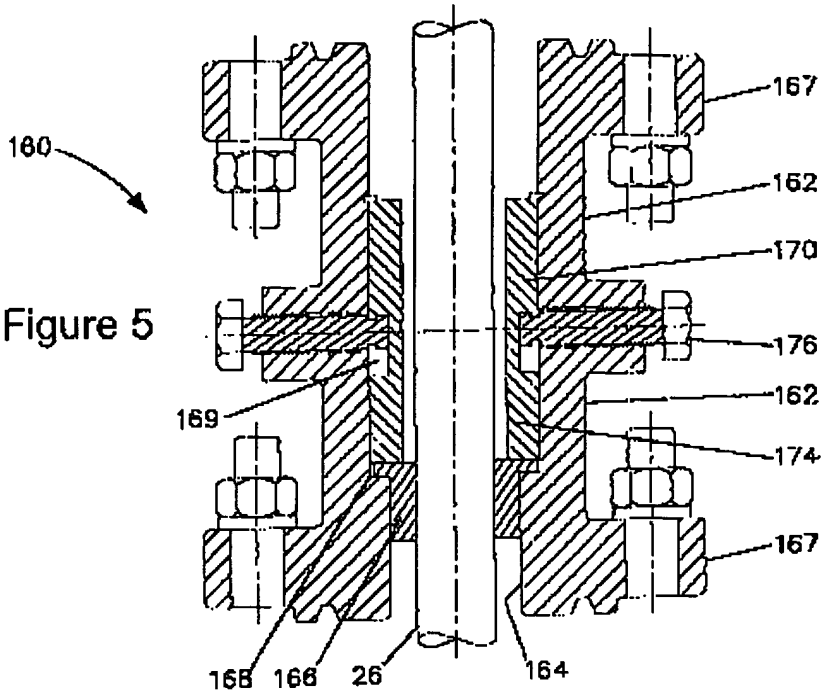

Figure 5

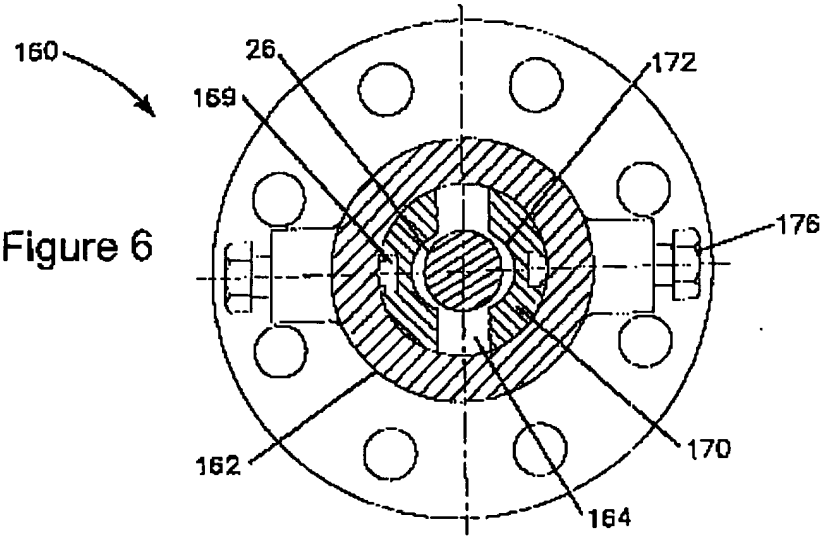

Figure 6

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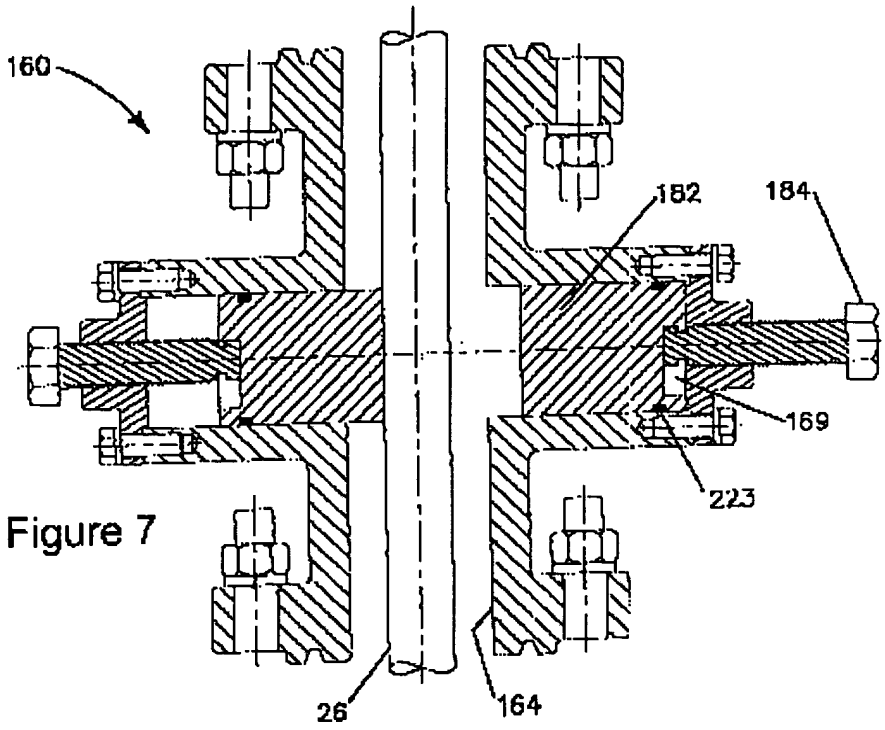

Figure 7

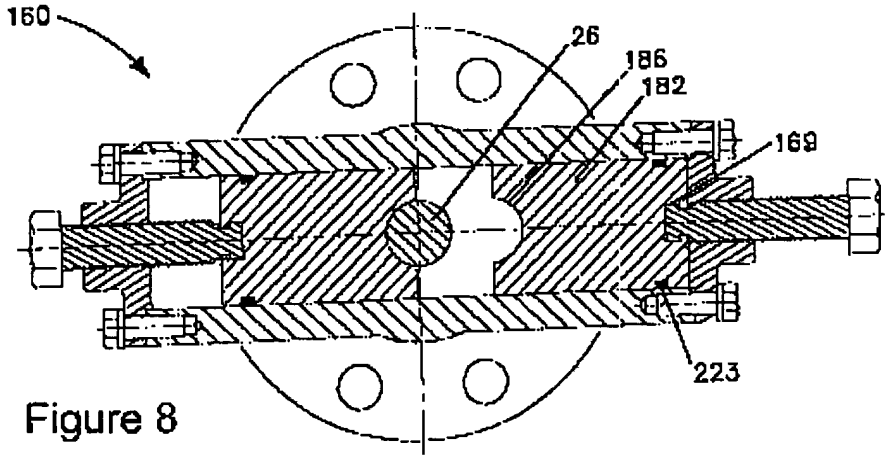

Figure 8

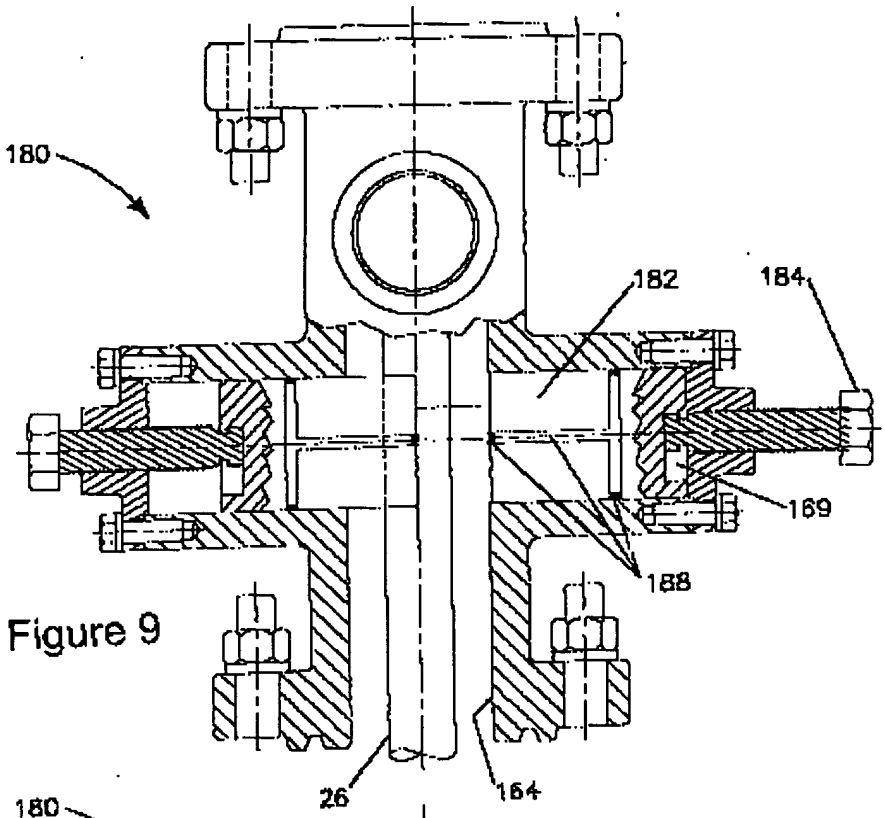

Figure 9

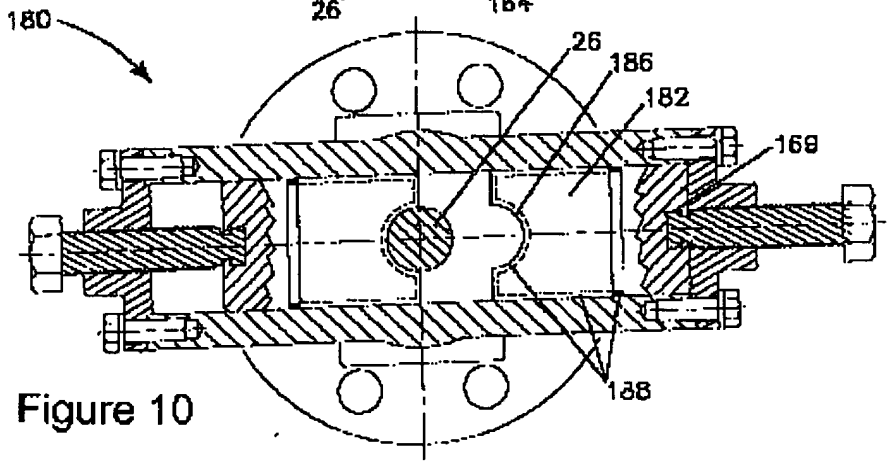

Figure 10

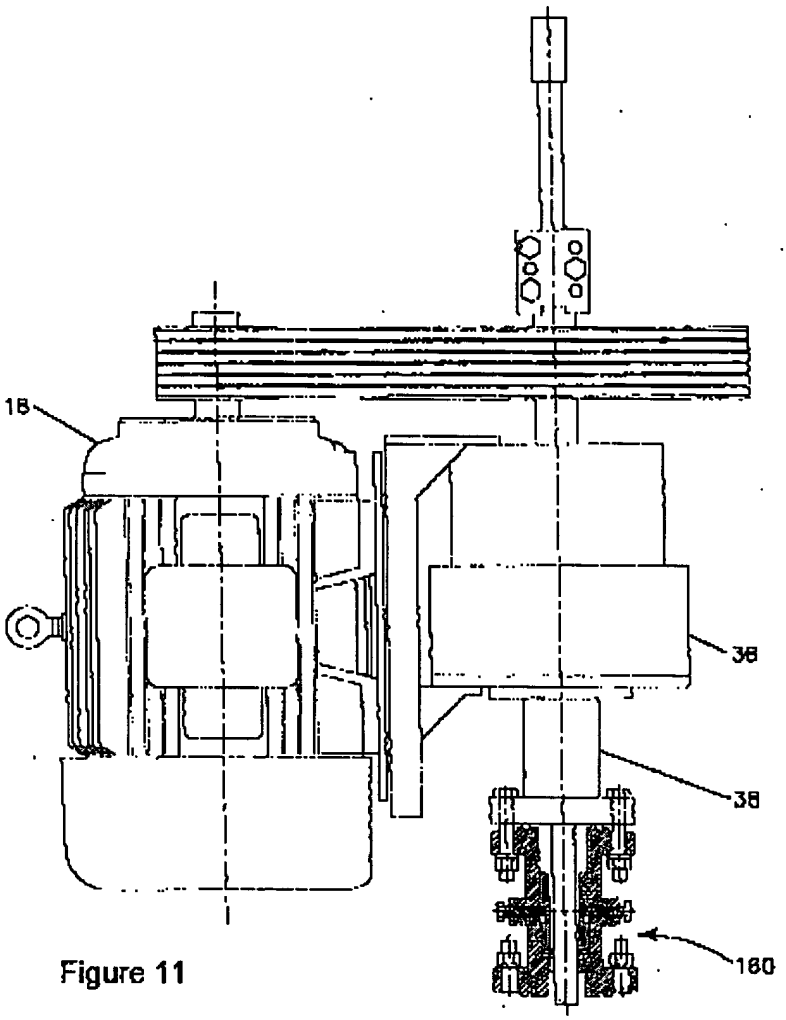

Figure 11

POLISH ROD LOCKING CLAMP

FIELD OF THE INVENTION

The present invention relates generally to progressing cavity pump oil well installations and, more specifically, to a polished rod lock out clamp for use in progressing cavity pump oil well installations.

BACKGROUND OF THE INVENTION

Progressing cavity pump drives presently on the market have weaknesses with respect to the stuffing box maintenance. Oil producing companies need a pump drive which requires little or no maintenance, is very safe for operating personnel and minimizes the chances of product leakage and resultant environmental damage. When maintenance is required on the pump drive, it must be safe and very fast and easy to do.

Due the abrasive sand particles present in crude oil and poor alignment between the wellhead and stuffing box, leakage of crude oil from the stuffing box is common in some applications. This costs oil companies money in service time, down time and environmental clean up. It is especially a problem in heavy crude oil wells in which the oil is often produced from semi-consolidated sand formations since loose sand is readily transported to the stuffing box by the viscosity of the crude oil. Costs associated with stuffing box failures are one of the highest maintenance costs on many wells.

Servicing of stuffing boxes is time consuming and difficult. Existing stuffing boxes are mounted below the drive head. Stuffing boxes are typically separate from the drive and are mounted in a wellhead frame such that they can be serviced from below the drive head without removing it. This necessitates mounting the drive head higher, constrains the design and still means a difficult service job. Drive heads with integral stuffing boxes mounted on the bottom of the drive head have more recently entered the market. In order to service the stuffing box, the drive must be removed which necessitates using a rig with two winch lines, one to support the drive and the other to hold the polished rod. This is more expensive and makes servicing the stuffing box even more difficult. As a result, these stuffing boxes are typically exchanged in the field and the original stuffing box is sent back to a service shop for repair--still unsatisfactory.

Prior art blow out preventers, while similar in structure, are not intended to grip the polished rod in metal to metal contact to suspend a polished rod and prevent axial or angular displacement of the polished rod. The function of the narrow elastomeric seal as sometimes used on existing blow out preventers is only to seal between the pistons, between the pistons

According to another aspect of the present invention, there is provided a polished rod lock out clamp for use to temporarily suspend a polished rod in an oil well installation, comprising a clamp body having a bore therethrough for receiving the polished rod in spaced relation to said bore; metal clamp members in said clamp body for engaging the polished rod in said bore, each said clamp member being radially movable with respect to the polished rod and each having a recess formed therein for grippingly receiving and engaging said polished rod for metal to metal contact therewith; and manipulating means secured to said clamp body and said clamp members for moving said clamp members between a polished rod gripping position in which said clamp members grippingly engage the polished rod to prevent rotation or axial movement thereof and a retracted position in which said clamp members are removed from the polished rod to permit rotational and axial movement of the polished rod in said bore of said clamp body.

In a still further embodiment of the present invention, there is provided a combined blow out preventer and polished rod lock out clamp for use in an oil well installation, comprising a housing having a bore for receiving a polished rod in spaced relation therethrough and opposed bores extending radially of said bore of said housing; clamp members in said housing for grippingly engaging said polished rod in said bore, each said clamp member comprising a metallic piston disposed in one of said radial bores, each piston having an inner end and a concavely curved recess in said inner end for receiving and grippingly engaging said polished rod in metal to metal contact along at least a portion of the length of said recess to suspend said polished rod in said oil well installation; elastomeric seal means to provide a seal between a portion of the length of said recess in said piston and said polished rod, a seal between said pistons and sealing of each piston in its associated radial bore to prevent well fluid from coming up a well bore and escaping to the exterior of the well bore when said pistons grippingly engage the polished rod; and manipulating means secured to said housing and said pistons for moving said pistons between a polished rod gripping position in which said pistons grippingly engage said polished rod to prevent rotation or axial movement thereof and a retracted position in which said pistons are removed from said polished rod to permit rotational and axial movement of said polished rod in said bore of said clamp housing.

In yet a further embodiment of the present invention, there is provided a polished rod lock out clamp operable to suspend a polished rod in an oil well installation, comprising a clamp body having an axial bore for receiving the polished rod in spaced relation to said bore; clamp members in said clamp body having an elongated arcuate inner metallic surface for grippingly engaging the polished rod in metal to metal contact, each said clamp member being radially moveable with respect to the polished rod; and radially disposed bolts threaded

into said clamp body for manipulation of said clamp members for moving said clamp members between a polished rod gripping position in which said clamp members grippingly engage said polished rod to prevent rotation or axial movement of the polished rod and a retracted position in which said clamp members are removed from the polished rod to permit rotational and axial movement of the polished rod relative to said axial bore of said clamp body.

In still yet another embodiment of the present invention, there is provided a polished rod lock out clamp, with blow out preventer seals, operable to suspend a polished rod in an oil well installation, comprising a clamp body having an axial bore for receiving the polished rod in spaced relation to said bore; two radially opposed pistons acting as clamp members, said clamp body having a piston bore for each said piston, each said piston bore extending radially of said axial bore of said clamp body, each said piston having an inner end proximate said axial bore of said clamp body, an arcuate inner surface being formed in said inner end to be semi-circular in cross-sectional shape for receiving and grippingly engaging said polished rod in metal to metal contact; radially disposed bolts threaded into said clamp body for manipulation of said pistons for moving said pistons between a polished rod gripping position in which said pistons grippingly engage the polished rod to prevent rotation or axial movement of the polished rod and a retracted position in which said pistons are removed from the polished rod to permit rotational and axial movement of the polished rod in said axial bore of said clamp body; and said pistons each having an elastomeric seal to seal between the polished rod and a portion of the length of said arcuate inner surface in each said piston, between said opposed pistons and between each said piston and its associated radial bore to prevent well fluids from escaping from the well bore, said elastomeric seals being compressible to allow said pistons to make metal to metal contact with said polished rod when said pistons are in said gripping position thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

This and other features of preferred embodiments of the present invention will become more apparent from the following description in which reference is made to the appended drawings in which:

Figure 1 is a view of a progressing cavity pump oil well installation in an earth formation with a typical drive head, wellhead frame and stuffing box;

Figure 2 is a view similar to the upper end of **Figure 1** but illustrating a conventional drive head with an integrated stuffing box extending from the bottom end of the drive head;

Figure 3 is a side elevational, cross-sectional view of one embodiment of a polished rod lock-out clamp according to the present invention;

Figure 4 is a top plan view of the clamp of **Figure 3**;

Figure 5 is a side elevational, cross-sectional view of another embodiment of a polished rod lock-out clamp according to the present invention;

Figure 6 is a top plan view of the claim of **Figure 4**;

Figure 7is a side elevational, cross-sectional view of another embodiment of a polished rod lock-out clamp according to the present invention;

Figure 8 is a top plan view of the clamp of **Figure 7**;

Figure 9 is a side elevational, cross-sectional view of one embodiment of a blow out preventer having an integrated polished rod lock-out clamp according to the present invention; and

Figure 10 is a top plan view of the clamp of Figure 9.

Figure 11 is a view of the drive head of **Figure 2** with a cross-sectional view of a polished rod lock out clamp connected.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

Figure 1 illustrates a known progressing cavity pump installation **10**. The installation includes a typical progressing cavity pump drive head **12**, a wellhead frame **14**, a stuffing box **16**, an electric motor **18**, and a belt and sheave drive system **20**, all mounted on a flow tee **22**. The flow tee is shown with a blow out preventer **24** which is, in turn, mounted on a wellhead **25**. The drive head supports and drives a drive shaft **26**, generally known as a "polished rod". The polished rod is supported and rotated by means of a polish rod clamp **28**, which engages an output shaft **30** of the drive head by means of milled slots (not shown) in both parts. Wellhead frame **14** is open sided in order to expose polished rod **26** to allow a service crew to install a safety clamp on the polished rod and then perform maintenance work on stuffing box **16**. Polished rod **26** rotationally drives a drive string **32**, sometimes referred to as "sucker rods", which, in turn, drives a progressing cavity pump **34** located at the bottom of the installation to produce well fluids to the surface through the wellhead.

Figure 2 illustrates a typical progressing cavity pump drive head **36** with an integral stuffing box **38** mounted on the bottom of the drive head and corresponding to that portion of the installation in **Figure 1** which is above the dotted and dashed line **40**. The main advantage of this type of drive head is that, since the main drive head shaft is already supported with bearings, stuffing box seals can be placed around the main shaft, thus

Improving alignment and eliminating contact between the stuffing box rotary seals and the polished rod. This style of drive head reduces the height of the installation because there is no wellhead frame and also reduces cost because there is no wellhead frame and there are fewer parts since the stuffing box is integrated with the drive head. The main disadvantage is that the drive head must be removed to do maintenance work on the stuffing box. This necessitates using a service rig with two lifting lines, one to support the polished rod and the other to support the drive head.

In order to overcome the above disadvantages, the present invention provides a polished rod lock-out clamp for use in clamping the polished rod during drive head servicing operations. The clamp can be integrated with the drive head or provided as a separate assembly below the drive.

One aspect of the present invention is the provision of a polished rod lock out clamp **160** for use in securing the polished rod when it is desired to service the drive head. The clamp may be integrated into the drive head or may be provided as a separate assembly, which is secured to and between the drive head and a flow tee, as illustrated in **Figure 11**. **Figures 3-6** illustrate two embodiments of a lock-out clamp. As shown, in each embodiment, the clamp includes a tubular clamp body **162** having a bore **164** for receiving polished rod **26** in annularly spaced relation therethrough. A bushing **166** is mounted on an annular shoulder **168** formed at the bottom end of bore **164** for centering the polished rod in the housing. Flanges **167** or threaded connections depending on the application are formed at the upper and lower ends of the housing for bolting or otherwise securing the housing to the underside of the drive head and to the upper end of the flow tee. The clamp includes two or more equally angularly spaced clamp members or shoes **170** about the axis of the housing/polished rod. The clamp shoes are generally in the form of a segment of a cylinder with an arcuate inner surface **172** dimensioned to correspond to the curvature of the surface of the polished rod. Arcuate inner surfaces **172** should be undersize relative to the polished rod's diameter to enhance gripping force. In the embodiment of **Figures 3** and **4**, spring means **174** are provided to normally bias the clamp members into an un-clamped position. In the embodiment of **Figures 5 and 6**, the ends of bolts **176** are generally T-shaped to hook into correspondingly shaped slots **169** in shoes **170** to positively retract the shoes without the need for springs **174**.

Clamp shoes **170** are actuated by radial bolts **176**, for example, to clamp the polished rod such that it cannot turn or be displaced axially. The lock out clamp may be located between the flow tee and the bottom of the drive head. Alternately, it can be built into the drive head.

In some applications it is preferable not to restrict the diameter through the bore **164** of the lock out clamp so that the sucker rods can be pulled through the clamp **160**. In this embodiment of the polish rod clamp as shown in **Figure 7 and 8**, where like numerals identify like elements, two opposing radial pistons **182** are actuated by bolts **184** to force the pistons together and around polish rod **26**. The polish rod is gripped by arcuate recesses **186**, which are preferably made undersize relative to the polished rod to enhance gripping force. Pistons **182** further include O-rings **223** to provide a better seal in bore **164**.

In a further embodiment of the polished rod lock out clamp, the clamping means are integrated with a blow out preventer **180**, shown in **Figures 9** and **10**. Blow out preventers are required on most oil wells. They traditionally have two opposing radial pistons **182** actuated by bolts **184** to force the pistons together and around the polish rod to effect a seal. The pistons are generally made of elastomer or provided with an elastomeric liner such that when the pistons are forced together by the bolts, a seal is formed between the pistons, between the pistons and the polish rod and between the pistons and the piston bores. Actuation thus serves as a means to prevent well fluids from escaping from the well.

In accordance with the present invention, an improved blow out preventer serves as a lock out clamp for well servicing. In order to serve this purpose, the pistons must be substantially of metal which can be forced against the polished rod to prevent axial or rotational motion thereof. The inner end of the pistons is formed with an arcuate recess **186** with curvature corresponding substantially to that of the polished rod. Enhanced gripping force can be achieved if the arcuate recess diameter is undersize relative to the polished rod. The sealing function of the blow out preventer must still be accomplished. This can be done by providing a narrow elastomeric seal **188** which runs across the vertical flat face of the piston, along the arcuate recess, along the mid height of the piston and then circumferentially around the piston. The seals can compress into the grooves which permits the pistons to engage the polished rod in metal to metal contact. Seal **188** seals between the pistons, between the pistons and the polish rod and between the pistons and the piston bores. Thus, well fluid is prevented from coming up the well bore and escaping while the well is being serviced, as might be the case while the stuffing box is being repaired. By including the sealing function of the BOP with clamping means, one set of pistons can accomplish both functions, enhancing safety and convenience without increasing cost or size.

The above-described embodiments of the present invention are meant to be illustrative of preferred embodiments and are not intended to limit the scope of the present invention. Various modifications, which would be readily apparent to one skilled in the art,

are intended to be within the scope of the present invention. The only limitations to the scope of the present invention are set forth in the following claims appended hereto.